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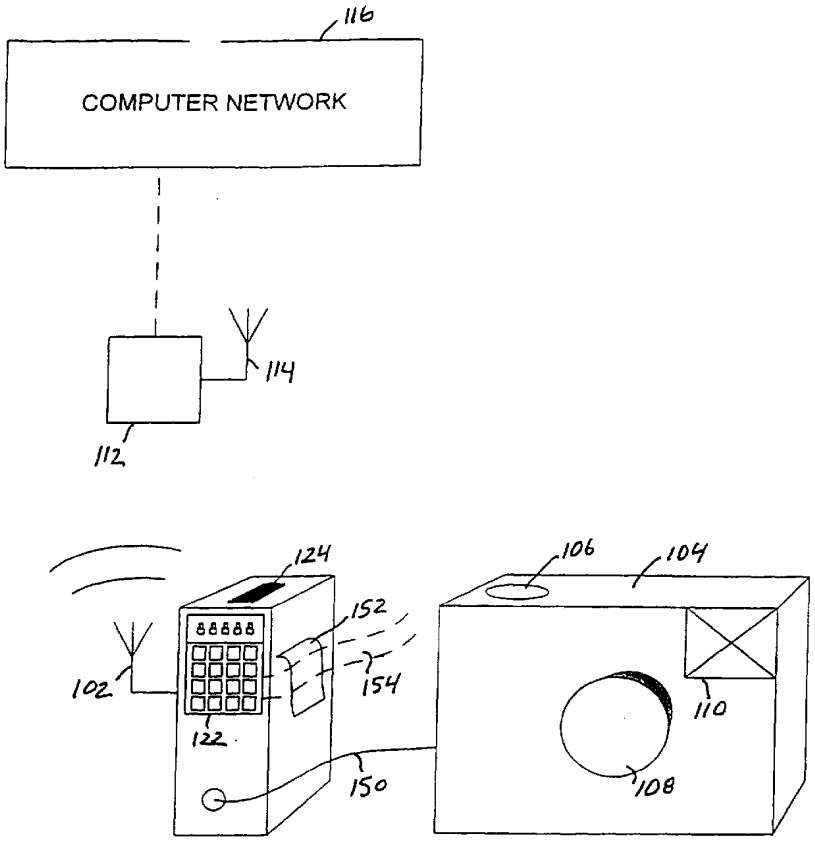
(54) Title: DIGITAL IMAGE TRANSFER SYSTEM AND METHOD



(57) Abstract: A method and apparatus for communicating acquired digital image data between a digital image capturing device and a computer or computer network. In one embodiment of the invention, a transceiver unit is communicatively coupled to the digital image capturing device for wirelessly receiving and transmitting information between the digital image capturing device and a transceiver coupled to a computer network. The transceiver unit may be either integral with the digital camera or a standalone device which communicates with the digital camera via one or more interfaces. For example, the transceiver unit may incorporate a card reader for receiving flash cards containing stored image data. Alternatively, the transceiver unit may be coupled to the digital camera via a high speed serial interface (such as a Universal Serial Bus or I.E.E.E. 1394 connection) or by means of a data storage device which is inserted into a memory card slot on the digital camera or is hardwired to the transceiver unit.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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DESCRIPTION

DIGITAL IMAGE TRANSFER SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

The present application is a continuation-in-part of Serial No. 08/852,557, filed May 7, 1997 in the names of Edward Acosta and Frank Kao, the entire disclosure of which is hereby incorporated by reference in its entirety, including drawings, and is hereby made part of this application for all purposes.

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates generally to digital imaging and transfer technology, and more particularly to a system and method for wireless communication of images from a digital image capturing device to a computer or computer network.

2. Related Art

Digital cameras are quickly replacing traditional, film-based cameras for many applications. With traditional cameras, the film functions to both record and store images. With digital cameras, however, separate devices typically perform these two functions. An image is first captured by the digital camera using an "image sensor", which may be a solid-state charge-coupled device (CCD) or a newer CMOS image sensor. The image is then stored in the camera in a buffer before being transferred to a local memory device. Often, the images are compressed in the camera to provide capacity for more images on the memory device. The images are usually then transferred to a personal computer and stored on its hard drive or other storage device. Software on the computer is then used to display or manipulate the image.

Almost all digital cameras utilize some form of removable storage device, usually flash memory cards, small hard disks (spinning magnetic disks), or even

floppy disks. The storage device can typically be removed and another inserted to increase the number of images that may be captured. Most flash cards used with digital cameras have been in the standard PC Card (PCMCIA) format that is widely used with notebook computers. However, smaller formats have been introduced and supported by different manufacturers, including: CompactFlash, Miniature Card, SmartMedia, MultiMedia cards, and MemorySticks, with other formats currently under development. Compatible card readers may be connected to a user's computer to download image information stored on the digital camera's removable storage medium. Cables are also used to connect some digital cameras to a serial, parallel, SCSI, USB or IEEE 1394 (Firewire) port on the computer. Alternatively, a docking station may be used to attach the camera to the computer.

All of the aforementioned methods of downloading digital images require the user to be proximate a computer for the physical transfer of image data. This requirement may preclude or inhibit many applications of digital cameras requiring real time or remote delivery of acquired digital images. Presently, there is no efficient apparatus or method for remotely communicating digital image data between a digital camera and a computer or computer network.

SUMMARY OF THE INVENTION

The present invention provides a flexible and convenient apparatus and method for wirelessly communicating acquired digital image data between a digital camera or other digital image capturing device and a computer or computer network. A transceiver unit is communicatively coupled to the digital image capturing device for wirelessly receiving and transmitting information between the digital image capturing device and a transceiver coupled to the computer network.

In one embodiment of the invention, the transceiver unit is integral with the digital camera. In another embodiment, the transceiver unit is a standalone device which communicates with the digital camera via one or more interfaces. For example, the transceiver unit may incorporate a card reader for receiving flash cards containing stored image data. Alternatively, the transceiver unit may be coupled to the digital camera via a high speed serial interface (such as a USB or IEEE 1394 connection) or by means of a data storage device which may be inserted into a memory card slot on the digital camera and is hardwired to the transceiver unit.

A system according to one embodiment of the present invention may operate in one or more image transfer modes, including an auto transfer mode in which acquired images are automatically transmitted to the computer network, and a store and forward mode wherein images are selectively transmitted to the computer network. In a corresponding embodiment of the invention, the transceiver unit includes local memory for storing or queuing the captured digital image data. The transceiver unit may also include an integral LCD or other viewing device for viewing or editing images prior to transmission to a computer network.

In accordance with one embodiment of the invention, information is communicated between the computer via a unique packet-based image transfer protocol.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the present invention can be obtained when the following detailed description of an exemplary embodiment is considered in conjunction with the following drawings, in which:

Figure 1 is a drawing of an exemplary digital image transfer system implemented in accordance with the present invention;

Figure 2 is a drawing illustrating an exemplary embodiment of the digital image transfer system of Figure 1 in which a digital camera and a transceiver unit are separable components;

Figures 3A-3C are drawings providing alternate embodiments of the digital image transfer system of Figure 2 in which image data is transferred between the digital camera and the transceiver unit via a variety of interfaces;

Figure 4 is a flow chart depicting exemplary digital image data transmission steps performed by the system of Figure 1 according to the present invention;

Figure 5 is a flow chart depicting exemplary details of the digital image data transmission method of Figure 4; and

Figure 6 is a block diagram of exemplary components of a transceiver unit element of Figure 2 in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is a drawing of an exemplary digital image transfer system implemented in accordance with the present invention. The system comprises a transceiver unit 100 integral with or coupled to a digital camera 104. The transceiver unit 100 comprises an antenna 102 for wireless communications with a computer or computer network 116 via a network transceiver 112 having a network antenna 114. In operation, images are captured by an imaging assembly (represented as element 108) of the digital camera 104 following a triggering event such as activation of a trigger 106. The acquired digital image data is then communicated to the transceiver unit 100, which may perform data manipulation on the acquired image data prior to transmission to the network transceiver 112.

Although the transceiver unit 100 is shown as an integral part of the digital camera 104 in Figure 1, it may be a separate or separable device as described more

fully below in conjunction with Figure 2. Further, data may be passed between the transceiver unit 100 and digital camera 104 via one or more interfaces as described more fully in conjunction with Figures 3A-3C. The transceiver unit 100 may be configured to operate using either a public wireless network or a private wireless network. For example, the transceiver unit 100 and the network transceiver 112 may operate over a commercial wireless network utilizing cellular digital packet data (CDPD) or other packet-based technology. In one embodiment of the invention described below, communications between the network transceiver 112 and the transceiver unit 100 occur via a unique packet-based image transfer protocol.

The computer network 116 itself may be of any size, including a standalone computer system. Alternatively, the computer network 116 may be configured as an intranet or as part of a larger network such as an internet. The connection between the network transceiver 112 and the computer network 116 is not considered critical to the invention. In addition to digital image data, it is further contemplated that software applets (such as anti-aliasing, image compression or polarizing applets) may be downloaded to the digital camera 104 from the computer network 116 via the transceiver unit 100.

The antenna 102 may be a wider variety of types, including a traditional antenna structure or a newer structure, such as a microstrip antenna or antenna array, and may be either directional or omnidirectional. Likewise, the network antenna 114 of the network transceiver may be of any type matching the communication characteristics of the antenna 102.

Although the term "digital camera" is used throughout the remainder of this specification, it is contemplated that any type of digital imaging device may be utilized within a system according to the present invention, and the term "digital

camera" is considered to be inclusive of all such devices. The digital camera 104 may incorporate a number of advanced features as known to those skilled in the art, and may include a flash unit 110. It is further contemplated that the digital camera 102 may be configured to capture audio information, which may then be appended to and transmitted with acquired image data.

Figure 2 is a drawing illustrating an exemplary embodiment of the digital transfer system of Figure 1, in which the transceiver unit 100 and digital camera 104 are separate or separable units. When separated, the transceiver unit 100 may be conveniently located in a separate carriage assembly, or in a shoulder pack or belt pack worn by a photographer. In one embodiment in the invention, the transceiver unit 100 includes an integral display 120 and keypad 122 for reviewing, selecting, annotating and/or editing images prior to transmission to the computer network 116. The display 120 may be based on any of a number of technologies, including a liquid crystal display (LCD) or a field emission display. Further, the keypad 122 may comprise a trigger button for activating transmission of captured digital image data or altering the transmission mode of the transceiver unit as described more fully below.

Figures 3A-3C disclose alternate embodiments of the digital image transfer system of Figure 2, and more particularly contemplated interfaces for transfer of data between the transceiver unit 100 and the digital camera 104. Beginning with Figure 3A, the transceiver unit 100 is shown as a separate unit configured to receive a data storage device or memory unit 130 via a slot 124. Following capture of digital image data by the digital camera 104, the memory unit 130 is removed from the camera and placed in the compatible slot 124 of the transceiver unit 100. Digital image data may then be extracted from the memory unit 130 by the transceiver unit 100 and configured for wireless transmission to the computer network 116. Prior to

transmission, the digital image data may be manipulated by the user. For example, only select images may be transmitted following a review of the acquired image data using the display 120.

In one embodiment of the invention, the memory unit 130 comprises a solid state flash memory card, such as a CompactFlash SmartMedia, or PCMCIA card. Because the user of the digital camera 104 may wish to utilize a number of memory units 130 at a time, the transceiver unit 100 may be provided with additional card reader slots 124. As described below, the transceiver unit 100 may also include storage capabilities allowing it to act as a buffer or a storage device for a large number of digital images.

Figure 3B illustrates an alternate embodiment of the invention in which the physical interface between the transceiver unit 100 and digital camera 104 comprises a memory unit emulator 140. The memory unit emulator 140 may be inserted in the digital camera 104 in the same manner as the native storage mechanism used by the digital camera 104. However, an umbilical cord 142 is provided between the memory unit emulator 140 and the transceiver unit 100 for allowing data to be directly communicated between the digital camera 104 and transceiver unit 100 in a nonintrusive manner. The memory unit emulator 140 may incorporate processing capabilities, including the capability to respond to a basic command set. A reader slot 124 may also be provided on the transceiver unit to provide greater flexibility and interoperation with a larger number of digital cameras 104.

Figure 3C illustrates an alternate embodiment of the invention in which the physical interface between the transceiver unit 100 and digital camera 104 comprises a cable 150. The link established by the cable 150 is preferably compliant with a high speed serial bus standard (such as a USB or I.E.E.E. 1394 compliant bus), although

parallel interfaces or other serial interfaces may be employed. It is further contemplated that the transceiver unit 100 may comprise more than one of the aforementioned physical interfaces for receiving captured digital image data such that the standalone embodiment of the transceiver unit 100 may be used with a wider variety of digital cameras 104. Other types of interfaces, such as an infrared interface, may also be utilized without departing from the spirit and scope of the invention.

A belt clip 152 is also illustrated in Figure 3C. The belt clip 152 may be used to attach the transceiver unit 100 to the belt 154 (or other article of clothing) of a photographer, thereby providing increased portability and ease of use for embodiments in which the transceiver unit 100 and digital camera 104 are separate or separable.

Figure 4 is a flow chart depicting exemplary digital image data transmission steps performed by the system of Figure 1 according to the present invention. Following capture of a digital image in step 200, the digital camera 104 stores corresponding digital image data in a buffer in step 202. As known to those skilled in the art, the digital image data may be stored in any public or proprietary file format, including but not limited to: BMP, CAM, FPX, J61, JPG, KDC, MDC, PCD, PCX, and TIF file formats.

Next, in step 204, the digital image data is transferred to the transceiver unit 100. Lastly, in step 206, the digital image data is transmitted to the network transceiver 112 for provision to the computer network 116. As previously discussed, the transceiver unit may perform selections, annotations, or otherwise manipulate the digital image data prior to transmission. In addition, initiation of step 206 may occur via a number of mechanisms. For example, the transceiver unit 100 can be configured

to automatically transmit all image data received from the digital camera 100. Alternatively, the transceiver unit 100 may function as a depository for such data, and only forward image data following a specific command or actuation of an integral triggering mechanism as discussed more fully below.

Figure 5 is a flow chart depicting exemplary details of the digital image data transmission method of Figure 4. In this embodiment of the invention, activation of a shutter at step 220 results in a digital image being captured in step 222. It is contemplated that activation of the shutter may be initiated in a traditional matter using a shutter button, or by some other automated or remote means. Following capture of the digital image, digital image data may be stored in a buffer as shown in step 224, or, alternatively, stored directly in a memory unit.

Next, in step 226, one or more images are selected for transmission to the computer network 116. The selected images may comprise an entire set or subset of images captured in accordance with steps 220 and 222. If a subset of images is to be selected, the selection process may occur by viewing the images, for example, on an image display integral to either the digital camera or the transmission unit 100.

Following the selection of images for transfer to the computer network 116, and if the image transceiver 100 is configured to operate in a trigger mode, a determination is made in step 228 as to the trigger status of the image transceiver 100. If the image transceiver has not been triggered as determined in step 228, the method proceeds to optional step 230 to determine if additional images are to be captured. If not, the process returns to step 228 to await a trigger event. If additional images are to be captured as determined in step 230, the process returns to step 220.

If the image transceiver has been triggered as determined in step 228, the process proceeds to step 232 and the image data for the selected digital image(s) is

transferred to the image transceiver 100. Next, the digital image data is transmitted to the network transceiver 112 for provision to a network-enabled computer or computer network 116. The process then returns to step 220 and the entire process may be repeated.

Numerous variations to the ordering of the steps shown in Figure 5 are possible without departing from the spirit or scope of the present invention. For example, the transfer of image data shown in step 232 may occur automatically following the capture of digital image data in step 220. In addition, the transfer of data to the network-enabled computer or computer network 116 may occur automatically following transfer of the data to the image transceiver 100. In this embodiment of the invention, at least step 228 may be omitted.

In embodiments of the invention in which acquired image data is stored in the transceiver unit 100, it is further contemplated that the images may be uploaded to the digital camera 104 for viewing and/or selection prior to the transmission of the selected images to the computer or the computer network 116. In addition, only select portions (e.g., "thumbnails") of the acquired digital image data may be transmitted to the computer network 116 in order to reduce the amount of data transferred and/or the transfer time. These select portions may then be used, for example, by a computer user to determine which images should be downloaded in their entirety. Numerous other operable variations to the disclosed embodiment will be apparent to those skilled in the art following a review of this specification.

Figure 6 is a block diagram of exemplary components of a transceiver unit 100 of Figure 2 in accordance with the present invention. In the disclosed embodiment, a control circuit or processor 300 for controlling image data manipulation and transmission operations is coupled to a data bus 302. A digital imager interface 304 is

likewise coupled to the data bus 302, may be compliant with one or more of the aforementioned standards. For example, the digital imager interface 304 may comprise a card reader or an image buffer coupled to the digital camera 104 via a data cable 150. The disclosed embodiment of the transceiver unit 100 also includes a memory system 308 coupled to the data bus 302. The memory system 308 functions to store acquired digital image data, and may also contain code for directing operation of the processor 300.

A wireless modem 306 is also connected to the data bus 302 and the antenna 102. A wireless modem of one embodiment of the invention is configured to both transmit and receive digital image data, and may also receive operating system updates for use by either the transceiver unit 100 or the digital camera 104. The wireless modem 306 may operate in accordance with a specialized packet transmission protocol such as that described below, or with a conventional transmission protocol.

A power supply 310 is also shown for providing power to the transceiver unit 100. The power supply may comprise a battery(ies) or an AC adapter or both. Alternatively, the transceiver unit may receive power from the digital camera 104 via a power link (not separately illustrated).

It is contemplated that the transceiver unit 100 may perform a number of image manipulation and formatting operations on select digital image data prior to transmission to the computer network 116. For example, filtering operations, framing operations, and the like may all be performed by the transceiver unit 100. In additions, updates to the control software for such operations may be downloaded from the computer network 116 via the wireless modem 306.

Thus, a flexible and convenient method and apparatus for wirelessly communicating acquired digital image data between a digital image capturing device and a computer or computer network has been described. In one embodiment of the invention, a transceiver unit is communicatively coupled to the digital image capturing device for wirelessly receiving and transmitting information between the digital image capturing device and a transceiver coupled to a computer network. The transceiver unit may be either integral with the digital camera or a standalone device which communicates with the digital camera via one or more interfaces.

In view of the above detailed description of the present invention and associated drawings, other modifications and variations will now become apparent to those skilled in the art. It should also be apparent that such other modifications and variations may be effected without departing from the spirit and scope of the present invention.

What is Claimed is:

1. A digital image transfer system, comprising:

an image acquisition device for acquiring digital images, the image acquisition device comprising an image storage mechanism; and

a wireless transmitter unit, the wireless transmitter unit communicating with the image storage mechanism for receiving data relating to acquired digital images,

the wireless transmitter unit further configured to communicate with a wireless receiver coupled to a computer.

2. The digital image transfer system of claim 1, wherein the wireless transmitter unit is coupled to the image acquisition device via a communications cable.

3. The digital image transfer system of claim 1, wherein data is communicated between the image acquisition device and the wireless transmitter unit via a serial communications interface.

4. The digital image transfer system of claim 3, wherein the serial communications interface is substantially compliant with the Universal Serial Bus standard.

5. The digital image transfer system of claim 3, wherein the serial communications interface is substantially compliant with the I.E.E.E. 1394 standard.

6. The digital image transfer system of claim 1, the wireless transmitter unit further comprising a display for viewing digital image data.

7. The digital image transfer system of claim 6, the wireless transmitter unit further comprising processing capabilities allowing a user to select specific digital image data for transmission to the computer.

8. The digital image transfer system of claim 1, wherein the wireless transmitter unit is integral with the image acquisition device.

9. The digital image transfer system of claim 1, the wireless transmitter unit further comprising an activation mechanism for initiating communications with a wireless receiver coupled to a computer.

10. The digital image transfer system of claim 1, the wireless transmitter unit, following receipt of acquired digital image data, configured to automatically initiate communications with a wireless receiver coupled to a computer.

11. The digital image transfer system of claim 1, the transmitter unit operating in accordance with a packet-based transmission protocol.

12. The digital image transfer system of claim 1, the image storage mechanism comprising a memory card.

13. The digital image transfer system of claim 12, the transmitter unit further comprising a memory card reader.

14. The digital image transfer system of claim 1, the image storage mechanism comprising a diskette.

15. The digital image transfer system of claim 1, the transmitter unit further comprising a memory for storing and queuing data relating to acquired digital images.

16. A wireless transmitter unit for communicating digital image data to a computer, comprising:

a wireless transmitter configured to operate with a computer-enabled receiver;

a digital camera interface for receiving acquired digital image data, the digital imager interface coupled to the wireless transmitter;

a memory system coupled to the digital imager interface for storing acquired digital image data; and

a control circuit coupled to the wireless transmitter for controlling digital image data manipulation and transmission operations.

17. The wireless transmitter unit of claim 16, wherein the wireless transmitter comprises a wireless modem.

18. The wireless transmitter unit of claim 17, the wireless modem operating in accordance with a packet-based transmission protocol.

19. The wireless transmitter unit of claim 16, further comprising receiver circuitry coupled to the control circuit for receiving data from a computer-enable transmitter.

20. The wireless transmitter unit of claim 16, the digital camera interface comprising a serial communications interface.

21. The wireless transmitter unit of claim 20, wherein the serial communications interface is substantially compliant with the Universal Serial Bus standard.

22. The wireless transmitter unit of claim 21, wherein the serial communications interface is substantially compliant with the I.E.E.E. 1394 standard.

23. The wireless transmitter unit of claim 16, the digital camera interface comprising a card reader for receiving a card-based data storage device containing digital image data.

24. The wireless transmitter unit of claim 16, the control circuit including processing capabilities allowing a user to select specific digital image data for transmission to the computer.

25. The wireless transmitter unit of claim 24, further comprising a display coupled to the control circuit for viewing digital image data.

26. The wireless transmitter unit of claim 16, further comprising an activation mechanism coupled to the control circuit for selectively initiating a transmission operation.

27. A method for communicating digital image data from a digital camera to a computing device, comprising:

acquiring a digital image with the digital image acquisition device;

providing data relating to the digital image from the digital image acquisition device to a wireless transmitter; and

transmitting the data relating to the digital image to a receiver communicatively coupled to a computing device.

28. The method of claim 27, wherein the step of transmitting the data is accomplished in accordance with a packet-based transmission protocol.

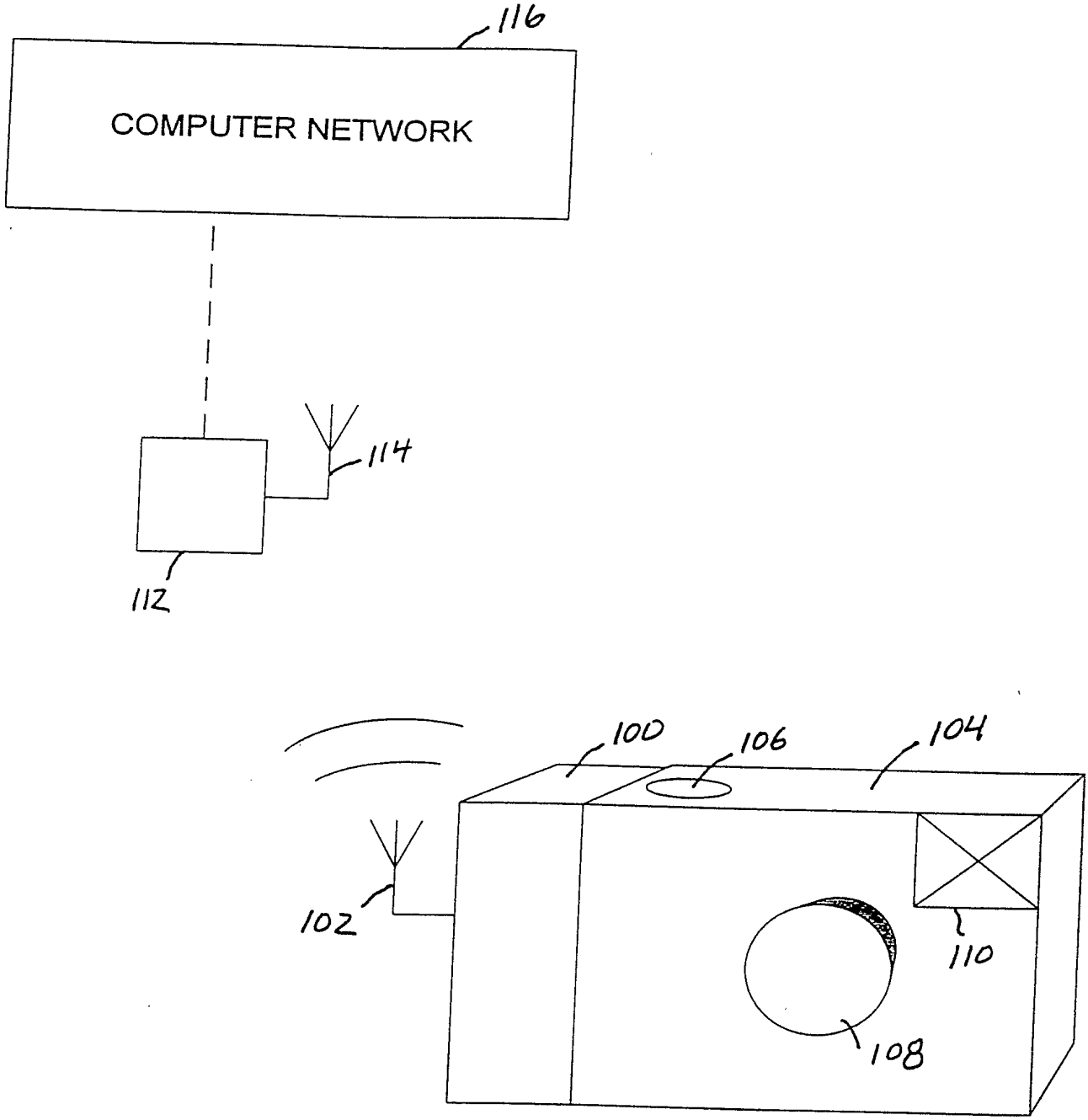

FIG. 1

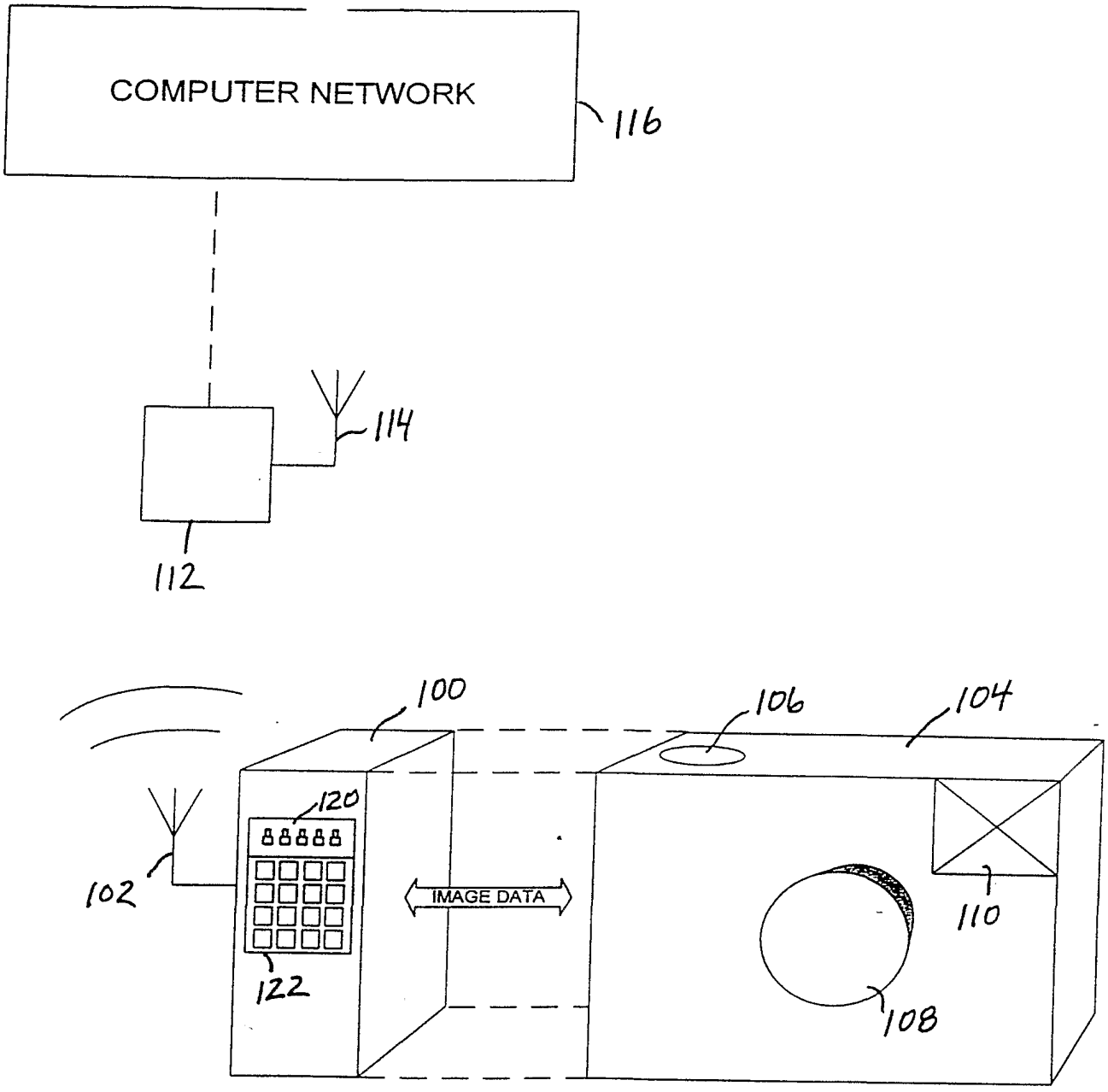
COMPUTER NETWORK
116
114
112
100
106
104
120
102
IMAGE DATA
110
122
108

FIG. 2

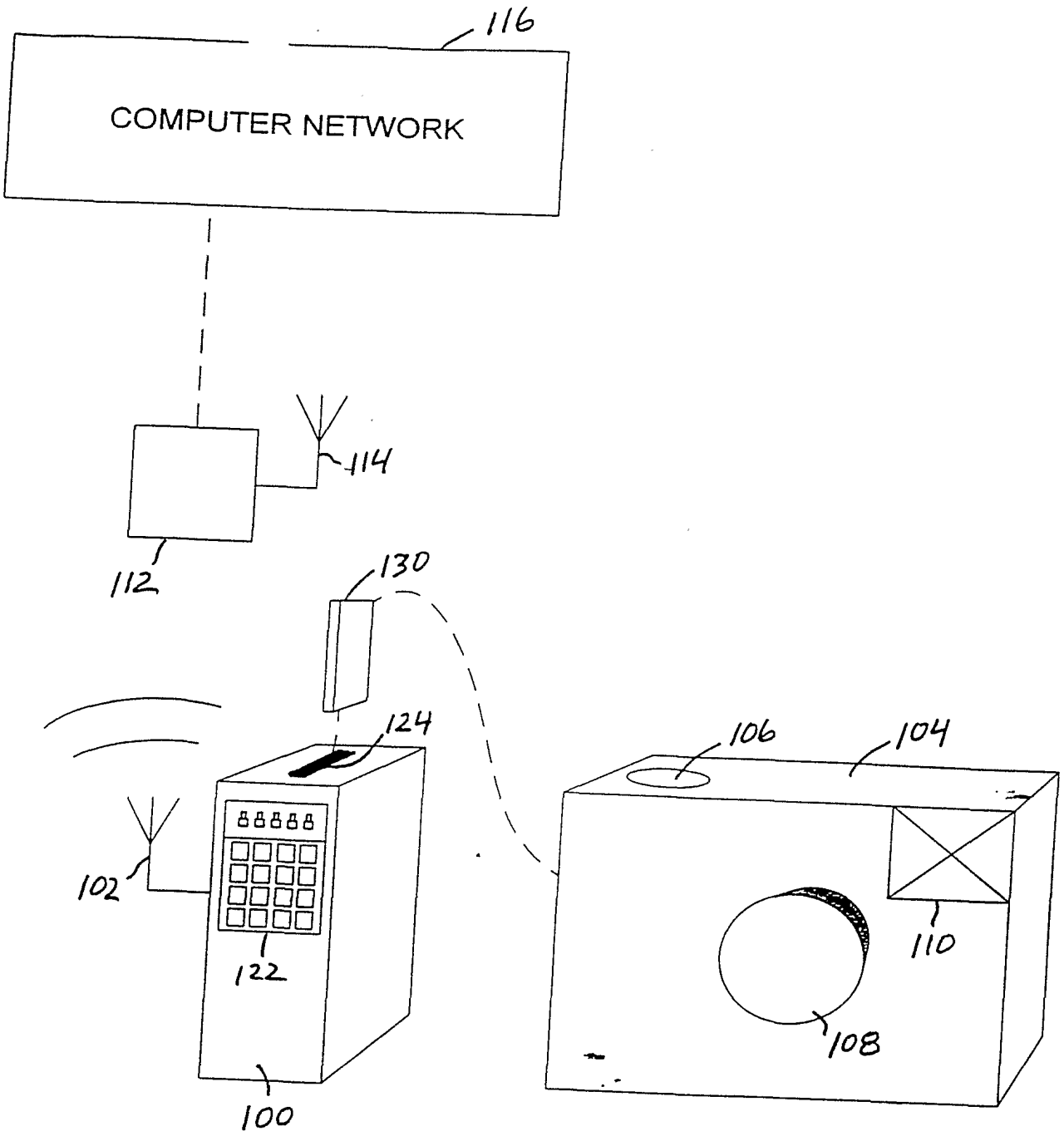
116
COMPUTER NETWORK
114
112
130
124
106
104
102
122
110
108
100

FIG. 3A

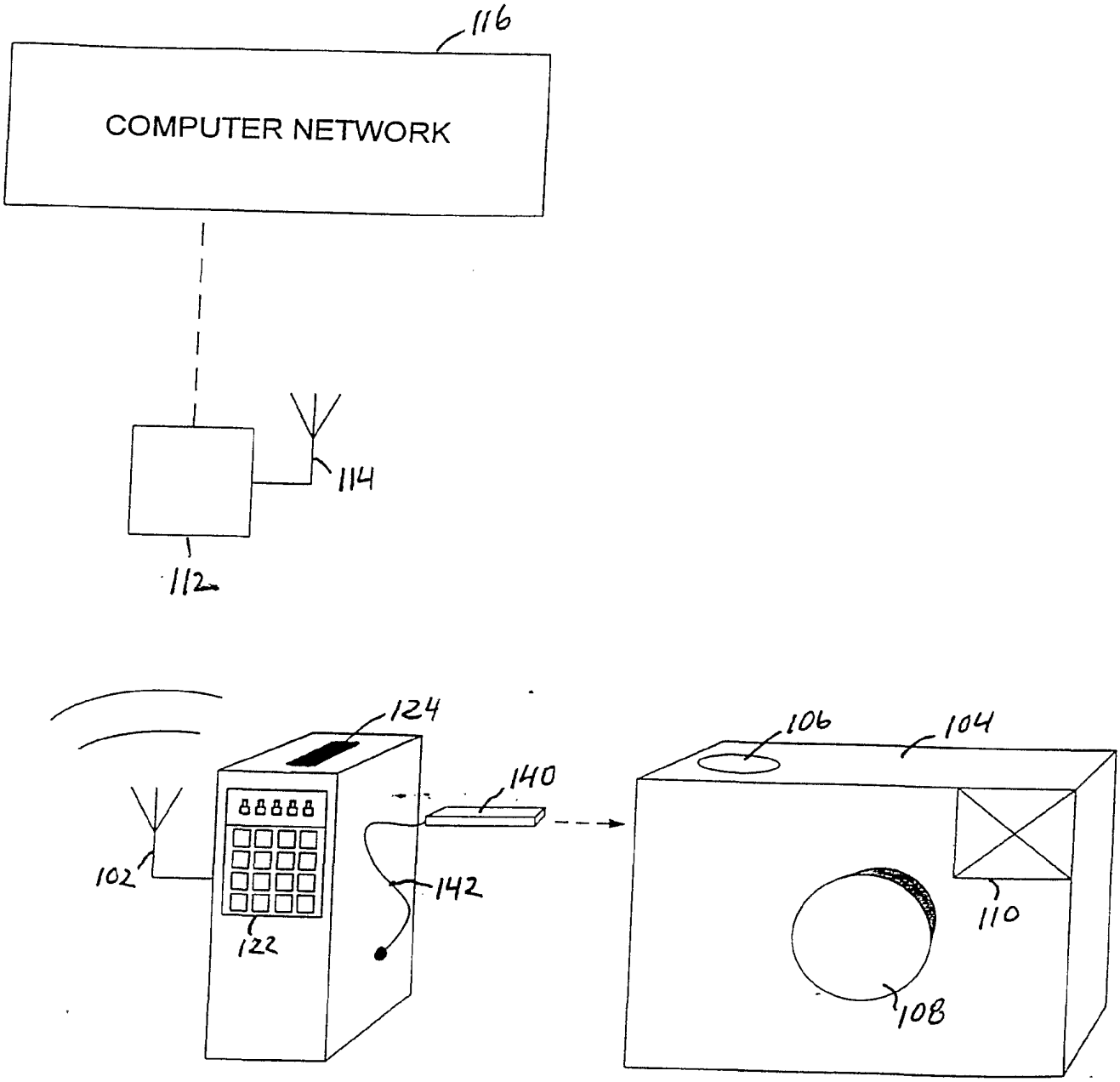
116
COMPUTER NETWORK
114
112
124
140
102
142
122
106
104
110
108

FIG. 3B

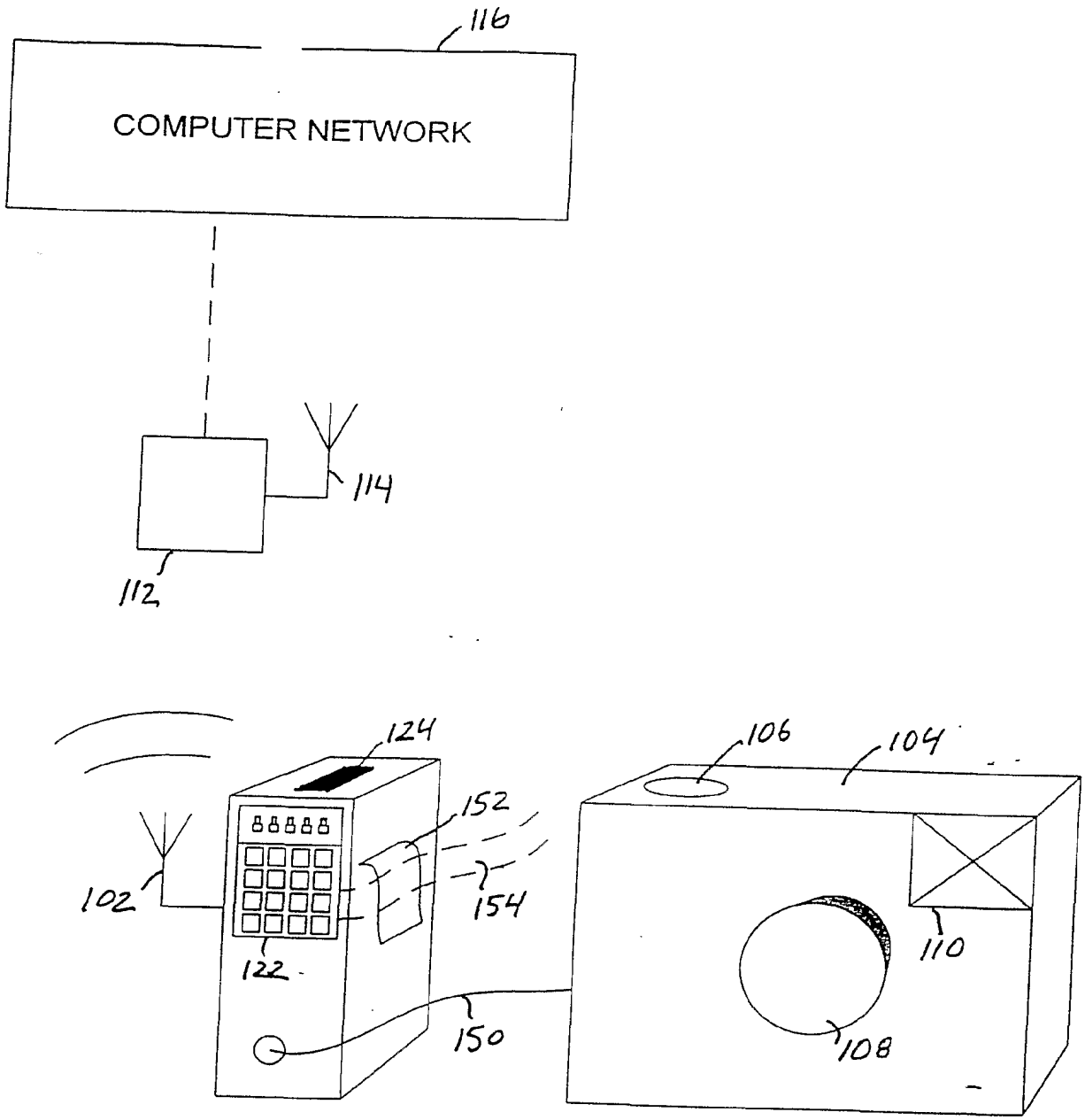
116
COMPUTER NETWORK
114
112
124
106
104
152
102
154
122
110
150
108

FIG. 3C

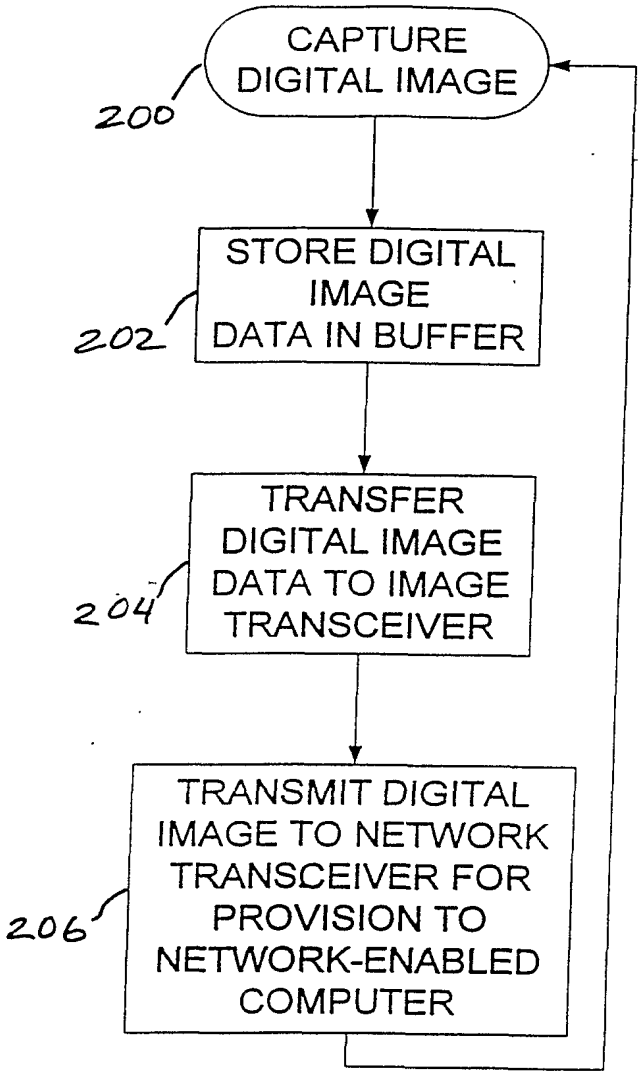
CAPTURE DIGITAL IMAGE
200
STORE DIGITAL IMAGE DATA IN BUFFER
202
TRANSFER DIGITAL IMAGE DATA TO IMAGE TRANSCEIVER
204
TRANSMIT DIGITAL IMAGE TO NETWORK TRANSCEIVER FOR PROVISION TO NETWORK-ENABLED COMPUTER
206

FIG. 4

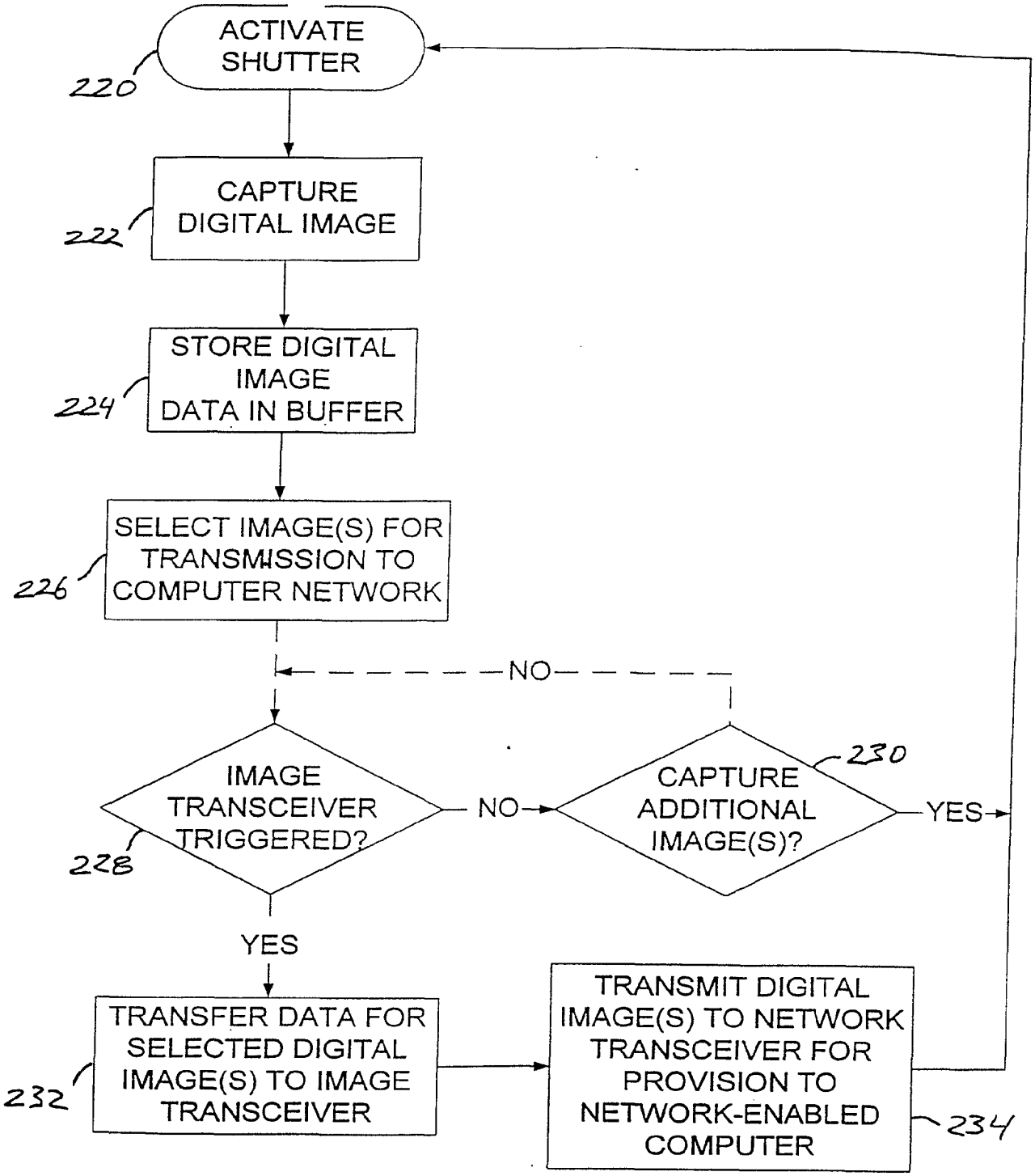
ACTIVATE SHUTTER
220
CAPTURE DIGITAL IMAGE
222
STORE DIGITAL IMAGE DATA IN BUFFER
224
SELECT IMAGE(S) FOR TRANSMISSION TO COMPUTER NETWORK
226
NO
IMAGE TRANSCEIVER TRIGGERED?
228
NO
CAPTURE ADDITIONAL IMAGE(S)?
230
YES
YES
TRANSFER DATA FOR SELECTED DIGITAL IMAGE(S) TO IMAGE TRANSCEIVER
232
TRANSMIT DIGITAL IMAGE(S) TO NETWORK TRANSCEIVER FOR PROVISION TO NETWORK-ENABLED COMPUTER
234

FIG. 5

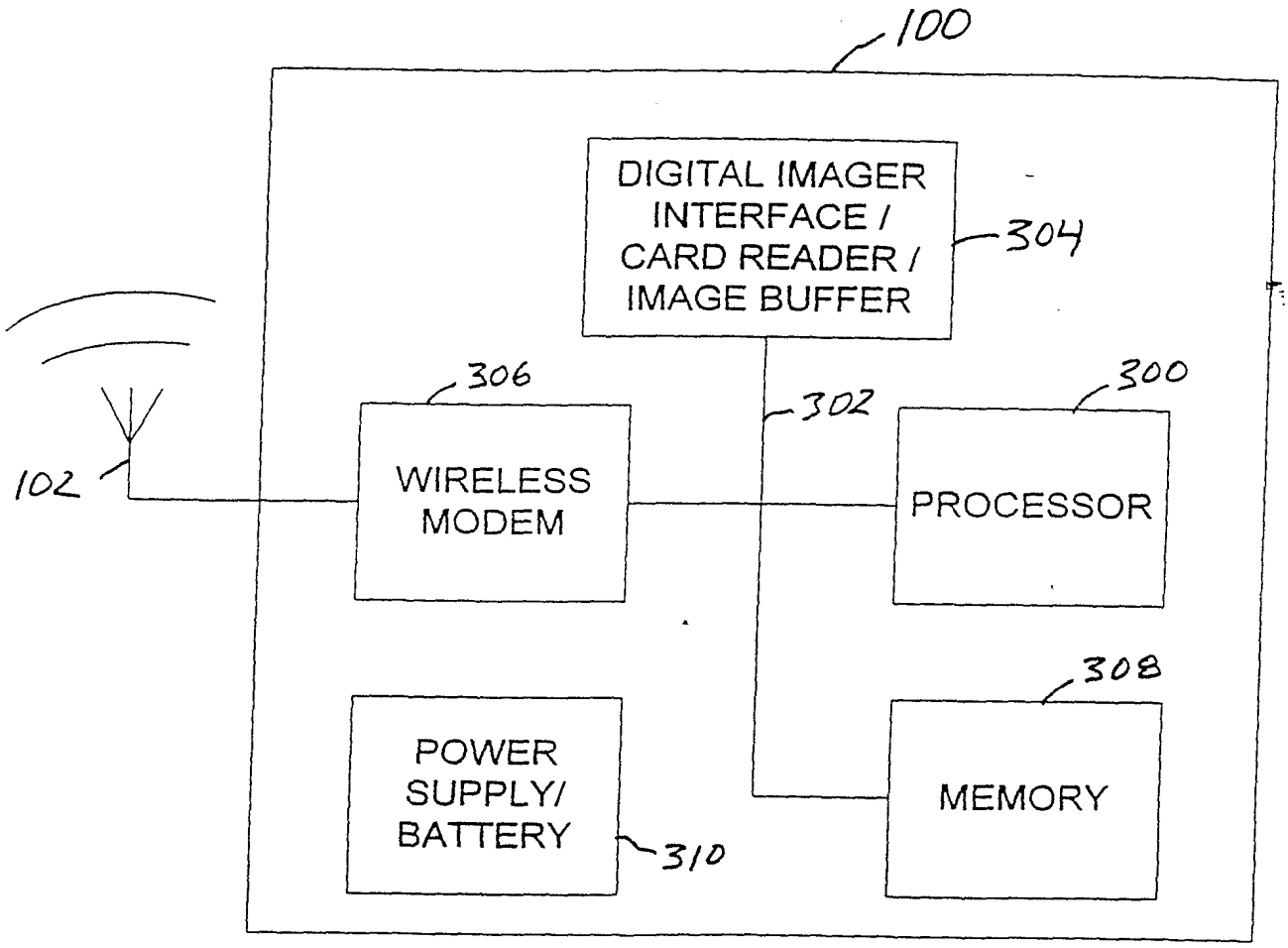
100
DIGITAL IMAGER INTERFACE / CARD READER / IMAGE BUFFER
304
306
302
300
102
WIRELESS MODEM
PROCESSOR
308
POWER SUPPLY/ BATTERY
310
MEMORY

FIG. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/04037

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N1/21

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	EP 0 833 494 A (CANON KK) 1 April 1998 (1998-04-01) the whole document ---	1,8,16, 27 2-4,6, 11,20, 21,28
X Y	US 5 806 005 A (CULLEN JOHN F ET AL) 8 September 1998 (1998-09-08) the whole document ---	1,16,17, 27 18
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 02, 29 February 2000 (2000-02-29) & JP 11 308588 A (NEC TELECOM SYST LTD), 5 November 1999 (1999-11-05) abstract --- -/--	1,12,13, 16,23,27

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
16 July 2001	20/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Hazel, J

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INTERNATIONAL SEARCH REPORT

International Application No
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